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SCIENCE AND TECHNOLOGY

ITALIAN RESEARCH COUNCIL: 1986 STATUS REPORT

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EUROPE/LATIN AMERICA REPORT

SCIENCE AND TECHNOLOGY

ITALIAN RESEARCH COUNCIL: 1986 STATUS REPORT

Rome RELAZIONE SULLO STATO DELLA RICERCA SCIENTIFICA E TECNOLOGICA
IN ITALIA PER IL 1986 in Italian 29 Sep 86 pp 1-32

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WESTERN EUROPE/SCIENTIFIC AND INDUSTRIAL POLICY

ITALIAN RESEARCH COUNCIL ISSUES 1986 STATUS REPORT

Rome RELAZIONE SULLO STATO DELLA RICERCA SCIENTIFICA E TECNOLOGICA IN ITALIA PER IL 1986 in Italian 29 Sep 86 pp 1-28

[Text] Science and Technology in the International Context

Resources allocated to R&D

- At world levels:

In recent years, the awareness of nations all over the world that science and technology act as a "catalyst," playing a role of strategic importance in economic and social development, has meant that the policy of the scientific world has been oriented toward increasing the quality and quantity of human and financial resources employed in research and development.

The available data on R&D at world levels are from 1980: the total number of researchers (equivalent to full-time) was 3,756,000, while world expenditures on R&D was \$207.801 billion. In this overall context, Italy spent 1.7 percent on R&D and Italian researchers represented 1.2 percent of the world total.

- In the OECD countries:

R&D expenditures in the economies of the main OECD countries in 1983 were as follows: the United States was at the top of the list with \$88.329 billion, followed by Japan (33.494), West Germany (18.130), France (13.134), the United Kingdom (12.553), Italy (5.568) and Canada (4.619).

Working on the basis that the level of resources allocated to research is expressed by total R&D expenditures as a percentage of gross national product (GNP), it can be seen that, for 1983, R&D expenditures in the United States were 2.7 percent of GNP, 2.6 percent in Japan, 2.6 percent in West Germany, 2.1 percent in France, 2.3 percent in the United Kingdom, 1.2 percent in Italy and 1.4 percent in Canada. It must be pointed out, however, that this indicator has been rising constantly since 1979. The recovery in R&D investments in countries all over the world has been accompanied by a similar recovery in spending on military research.

Still with reference to 1983, the total amount spent on R&D by the EEC countries was scarcely two-thirds of the amount spent by the United States.

If we analyze the distribution of researchers in the OECD countries since 1975, we see that Japan accounts for 24 percent and the EEC countries for 25 percent. All the other OECD countries together account for only 9 percent of the total. Within the OECD area, Italian researchers represent 3 percent of the total number. In 1983, the total number of Italian researchers equivalent to full-time was 63,000.

In the highly industrialized countries, an evolution in the numerical ratios of the various categories of research personnel has become obvious. In order to be able to carry out their work, researchers normally need support personnel. Over the years, there has been a tendency for the number of personnel employed for this purpose to decrease. In Italy, for example: in 1971, 10 researchers had 16 personnel (technical and auxiliary personnel) working for them; by 1984, this figure had dropped to only 9.

Financing of Research and Development

The major sources of financing for research and development are industry and government. In the United States the funding provided by industry in the 1980s is at the same level as that provided by government bodies. In West Germany and Japan, on the other hand, the private sector makes the larger contribution, while in France, the UK and Canada, public sector financing is greater than that of the private sector. In Italy, public and private sector financing became equal in 1982. From 1983 onward, however, there has been a reversal of this trend.

When we look at 1983 in greater detail, the following situation emerges: in the United States, industry's contribution to spending on R&D was 49 percent, while that of the public sector was 48.4 percent; in Japan, the figures were 65.2 percent (industry) and 24 percent (public sector); in West Germany, 57 percent (industry) and 41.6 percent (public sector); in France, 42 percent (industry) and 54 percent (public sector); in the United Kingdom, 42 percent (industry) and 49.5 percent (public sector); in Italy, 45.1 percent (industry) and 52.4 percent (public sector) and, finally, in Canada, 38.6 percent (industry) and 52.2 percent (public sector).

However, from a breakdown of total public sector financing of research into percentages of the total figure allocated to different areas of research (Table A), it can be seen that the social and economic objectives of the major OECD countries vary greatly from one country to

another. Moreover, the greatest difference which emerges from this picture concerns financing for university research. In the United States, for example, no public funds are allocated to the universities for R&D, while in the other countries, and in Japan in particular, this sector of research is of great importance.

In addition, in 1984 the United States allocated a mere 0.1 percent of resources to land-use planning, while the amount allocated by the U.S. to medical research--equal to 5.5 trillion lire--was in fact greater than the total amount allocated to R&D as a whole by the public sector in Italy in the same year.

In Europe and Japan, a large amount of public sector financing is allocated to energy research and to research into ways of improving industrial productivity. The areas of industry to which Italy gives priority in this sense are electronics and telecommunications.

With regard to the amount spent by industry in the most highly industrialized OECD countries (Table B), it can be seen that in 1981 the United States accounted for 50.2 percent of the total, while Japan accounted for 15.1 percent and Italy 2.5 percent.

Patents and the Technological Balance of Trade (TBT)

Patents are generally considered to be one of the indicators of the technological output of a nation. The available figures provide two different categories of information on patents, that is, the number of applications submitted for the granting of patents, and the number of patents actually granted.

From 1965 to 1983, there was a modest increase in the number of applications made for patents in the OECD countries, with the exception of Japan which, since 1968, has had the largest number of applications for the granting of patents of any of the OECD countries; by 1983, Japan accounted for 33 percent of all applications for patents in the OECD countries. In the same period, there was a general drop in the number of patent applications made by the other OECD countries.

In Italy, the number of patent applications submitted fell from 5.4 percent to 4.2 percent.

With regard to the number of patents granted, on the other hand, we have the following situation: over the last two decades, the United States has led the field in this respect. During the same period, however, Japan has doubled its share of patents granted, from 8.7 percent in 1965 to 19 percent in 1982.

In the case of Italy, it is difficult to draw any firm conclusions from the available figures because of the problems encountered in this country in getting patents granted quickly.

Between 1965 and 1983, the United States was at the top of the list with regard to the number of patents granted, followed by West Germany. The only industrialized nation to make an outstanding leap forward during this period was Japan, increasing its share of the OECD total from 3 percent in 1965 to 12.9 percent in 1983.

The technological balance of trade (TBT) measures the exchange of "intangible" technology (in other words, the exchange of technological information) in the form of rights to intellectual and industrial property such as patents, licences, know-how and technical assistance.

The TBT data collected by the OECD for the period 1972-1982 concerns nine countries which, as a whole, account for between 80-90 percent of all exchanges between the most highly industrialized nations of the West.

If we examine the figures concerning R&D expenditures in conjunction with the information available on patents and on the flow of technology measured by the TBT, certain conclusions can be drawn concerning the strategies adopted by the economies of three main OECD areas. If we take R&D expenditures by industry as our reference parameter, we can see that while the United States basically tends to transfer technology to other countries through the subsidiaries of U.S. multinationals (65 percent of total revenue), Japan essentially does this by means of patents (14 percent of applications for the granting of patents are made abroad).

The high percentage of patent applications from foreigners filed in Europe (66 percent) indicates that European and foreign inventors regard Europe as a particularly interesting market (it must be remembered, though, that if Europe were a single nation like the United States, the overall number of applications would be lower).

Finally, the large number of patent applications abroad would appear to indicate that the countries of Europe have created the foundations needed to penetrate overseas markets.

The Resources Allocated to Research in Italy

Financial resources allocated to R&D activity

During 1986 the R&D/GNP ratio should reach 1.47 percent. Despite the fact that the percentage of GNP allocated to research and development

in Italy has been growing steadily since the beginning of this decade, it will take a considerable time as well as substantial amounts of money before the gap between Italy and the other industrialized nations can be bridged or, at any rate, lessened (Table C).

In the last eighteen years (1967-1985), the amount of financing allocated to research has increased by more than 214 percent in real terms (at 1970 prices), with an average annual rate of increase of 6.6 percent.

This increase in financing, however, has not been a uniform increase. It developed as follows:

- There was a major increase in the first six years (1967-73). The Italians became aware of the gap that existed between themselves and other European and non-European nations, and this led to the approval and implementation of certain measures such as the special programs of the National Research Council (CNR), the SIRIO program, the creation of the IMI Fund for Applied Research (IMI--Italian Institute for Financing Personal and Real Property), and of certain other funds for CNEN (National Committee for Nuclear Energy) and INFN (National Institute of Nuclear Physics) as well as international cooperative programs. It also led to a greater emphasis on university research and the importance of nuclear energy.

- Growth in the 1970s (1973-80) was lower because of the oil crisis and the inflationary period that resulted from this crisis. During this period, which served as a time for reflection, there was a shift away from large-scale financial interventions, with attention being focused instead on specific research problems and on the question of scientific personnel. During this period, a greater awareness emerged of the importance of technological development. CIPE (Interministerial Committee on Economic Planning) embarked on a process of institutional reorganization of scientific activity, defining areas of competence and sectors of research activity, and formulating administrative procedures as part of a program for an overall restructuring of the research organizations in Italy. 1976 witnessed the launch of the first 18 Finalized Projects [Progetti Finalizzati] in five different sectors (health, environment and land-use, energy, food supplies, high technology); these projects were to last for 5 years, with a total outlay of 229 billion lire. Measures were also approved for Italian universities (with special emphasis on construction and on universities in southern Italy). The first steps were taken--extremely slowly--toward the creation of structures in southern Italy and on the islands. It was not until the end of the 1970s that a start was made on the allocation of financing for agriculture and for industrial research, and that funds were established for industrial reconversion and restructuring.

In 1973-74, the amount of financing given to the universities accounted for more than 50 percent of the public funds allocated to research. However, since the allocations made by the Ministry of Education for university research increased at a rate which was lower than the rate of inflation, they represented a progressively smaller percentage of total state R&D expenditures. The energy crisis worsened at this time.

- It was not until 1979 that an upswing occurred in R&D investments. Between 1979 and 1985 the increase in real terms in research expenditure was 75.3 percent, equivalent to an average annual increase of 9.8 percent. In this period, laws were issued regarding university education and for the restructuring of CNEN [National Committee for Research & Development of Nuclear Energy and Alternative Energy]. INFN's fourth 5-year plan (1980-84) was approved, with expenditures of 2.9 trillion lire. The National Space Plan, which will have spent more than 850 billion lire between 1980 and 1986, was approved. A number of new finalized projects were initiated in 1978. In the period 1980-82, a series of second-generation finalized projects were initiated, and other finalized projects were begun in 1985. The Special Program for Applied Research in the South of Italy was approved. Under the provisions of law No. 46/1982, the special Revolving Fund for Technological Innovation was established under the auspices of the Ministry of Industry, and provisions were made for refinancing of the IMI Fund. The same law also provided for the creation of special National Research Programs. Finally, in 1985, two 5-year plans were approved, one for ENEA (1985-89, with expenditures of 5.4 trillion lire) and the other for INFN (1984-88, with expenditures of 1.023 trillion lire).

The projected R&D allocations for 1986 amount to a total of 11.173 trillion lire (a figure which represents an increase of 20.8 percent--equal to 1.928 trillion lire--over 1985). Of this total, 5.473 trillion lire will come from the public sector (with an increase of 24 percent--equal to 1.059 trillion lire) and 5.7 trillion lire from private companies, state participation companies and ENEL (National Electricity Board) (with an increase of 18 percent - equal to 869 billion lire) (Table D).

This means, therefore, that industry covers more than 50 percent of the total allocations for research, with a nominal increase of 28 percent over 1985. Although the increase in the contribution made by ENEL is smaller, it is still substantial (+15.7 percent over 1985). The increase in real terms in the contribution made by state participation companies has decreased (+4.3 percent compared with the previous year).

In the public sector, if we exclude universities, government bodies represent the sector providing the greatest increase in allocations compared with 1985 (+35.4 percent). On the other hand, the increase in the contributions of the research organizations (CNR and ENEA) and the other government bodies does not even cover the projected rate of inflation; the increase in the funds provided by these organizations is in line with that provided by state participation companies (+4.4 percent and +3.2 percent, respectively).

In 1967, the contributions made to R&D expenditures by the public and private sectors were almost equal (49 percent from the public sector and 50.9 percent from the private sector). This situation has changed in subsequent years. The percentage contribution made by industry grew until, by 1980, it reached 59 percent of the total figure. In the same year, this gap started to open up again. In this period, state-owned companies grew from 11.4 percent of the national total (1967) to 21.7 percent (1984). With regard to government organizations, universities showed a decline, falling from 27.9 percent in 1967 to 19 percent in 1983; which corresponds to a reduction of research during this period. In the same period, government research organizations (CNR, ENEA, INFN, etc.) showed a growth from 18.6 percent to 23.3 percent, even though the overall amounts spent by government structures have been constantly lower than the financing allocated since a portion of this funding has been going to research conducted by industry.

Public sector funding of R&D (Table E)

Between 1967 and 1984, the contribution made by government bodies and, within this context, by the CNR and ENEA, as well as government authorities and companies, increased in real terms by more than 250 percent.

Up until 1979, university research was funded solely by the financing provided by government bodies, and by the CNR in particular.

Only at the beginning of the 1980s were universities allocated funds of their own, which were supplemented by the contributions made to university research by other organizations. In 1983, these contributions tended to undergo a change.

During the 15-year period under examination in this report, government policy increasingly tended to favor companies involved in research and technological innovation. This was partly the result of the measures referred to earlier in this report (that is, in 1967, 1.7 percent of public sector financing went to companies, while by 1984 this figure had risen to 19 percent). Companies finance 70 percent of their research, and this contribution has been increasing in recent years.

Financial resources for R&D in the public sector in 1986--breakdown into bodies and areas of competence (Table F).

The allocation made by ministries and government bodies in 1986 showed a 24 percent increase over the previous year.

Ministry of Education (including universities): There was a 50 percent increase in the budget allocated compared with 1985. Universities account for one-third of R&D allocations. Faculty costs increased from the 1985 figure of 1.050 trillion lire to 1.273 trillion lire in 1986.

ENEA: The budget for 1986 has remained unchanged. The allocation for nuclear energy decreased by 8.7 percent compared with 1985, despite the fact that this sector receives the greatest share of the financing (approximately 63 percent of the entire budget). Resources allocated to other sectors increased.

CNR: There was a 10.2 percent increase in the allocation compared with 1985. Twenty-five percent of the total budget was allocated to interdisciplinary research, including research conducted within the context of the finalized projects and the strategic programs; an additional allocation of 187 billion lire was made for the National Space Plan (Fig. G; Table F).

Italian contributions to international organizations increased (215 billion lire in 1986 against 160 billion lire in the previous year).

Fund for the South of Italy: The allocation for 1986 is 329 billion lire. Under the provisions of law No. 64/1986, much of this will be used for interdisciplinary research, but high priority will also be given to social research, agricultural research, engineering and technology.

Ministry of Defense: There was a 3.9 percent increase over 1985.

INFN: After the major increase obtained in 1985 under the long-term plan, the allocation for 1986 increased by 3.5 percent.

Ministry of Agriculture: The 1986 allocation is to be cut by 7.2 percent, the allocation covers 23 experimental centers and the cost of personnel. The measures regarding other areas of intervention are presently being examined by parliament.

Therefore, the breakdown by sectors looks much the same as in 1985 (Fig. G):

- engineering and technological research: 19.8 percent (the largest portion);

- nuclear research: 12.5 percent (almost exclusively ENEA allocations);
- physical sciences: 12.1 percent;
- biological and medical research: 11.2 percent.

The picture that emerges for 1986 is that there is a tendency to give priority to those sectors which have the greatest impact on industry and the economy.

Financing by objectives (Tables F, H, L)

The NABS classification (Nomenclature for the Analysis of Scientific Budgets) used by the EEC evaluates government research activity, and also categorizes R&D activity. Certain difficulties exist in the case of universities (which play a leading role in R&D, with an allocation of 22.7 percent of the total); if we produce a breakdown according to sectors, we can see that the majority of funds go to engineering and technology, and biology and medicine.

From the above classification it can be seen that the CNR's situation is as follows:

- 21.8 percent of financing given to the research organizations is used for pure research;
- 21 percent is used for industrial research;
- 15 percent is used for health research;
- 9.7 percent is used for agricultural research;
- 9.3 percent is used for research into environmental pollution.

The greater part of the total allocations made to government bodies for R&D goes to the energy sector, industry, and defense. Only a small percentage of the total is used for environmental research, land-use planning, environmental pollution, and social research.

ENEL and state participation companies direct the majority of their investments toward industry and the defense sector. Therefore, it can be seen that, with the exception of the universities, government, state-owned companies and state participation companies have the following order of priorities: industry (21.1 percent of the total); energy (16.3 percent); defense (approx. 12 percent); space research (7.7 percent); pure research (5.8 percent).

Breakdown of research expenditure by categories (pure research, applied research and development)

In 1967, the emphasis placed on each of the above three categories varied greatly from one to the other. The projections for 1986, however, indicate that these differences have flattened out to some

extent (37.9 percent pure research, 38.2 percent applied research, 23.9 percent development). Toward the end of the 1970s there was a tendency on the part of government bodies to give priority to applied research rather than to pure research. Industry, on the other hand, continued to maintain more or less the same balance between the three areas as in previous years, giving priority to applied research (41.3 percent) and development (57.5 percent), with only a very small allocation being made to pure research (1.2 percent).

- Pure research:

97 percent of pure research is conducted by government bodies, particularly by universities, INFN and the CNR.

Between 1967 and 1986 expenditures in this category increased by 135 percent. During the same period, the increase in spending on pure research in industry was lower than that in the public sector (59 percent). On the other hand, as we mentioned earlier in this report, the percentage of public sector resources allocated to pure research is little more than 1 percent.

- Applied research:

38-40 percent of applied research is conducted by government bodies and industry. Over the last 15 years the part played in this area by government bodies has increased by 181 percent, whereas that played by industry has grown by 304 percent.

- Development:

High priority is given to development by both the public and private sectors. Allocations to this sector have increased both in relative terms and in absolute terms, with government making a greater contribution than industry.

Financing of scientific research in universities

The provisions of DPR (Decree of the President of the Republic) 380/1980 changed the method of allocation of funds for scientific research in universities. Today, 60 percent of the total budget is allocated to funding of the individual universities, whereas the remaining 40 percent is used for research projects of national interest. Moreover, in 1981 a system was introduced whereby fourteen consultative committees (each one representing a specific discipline) were established under the aegis of the Ministry of Education. These consultative committees are responsible for evaluating the projects submitted and allocating funding.

Of the projects submitted and funded between 1981 and 1984, the areas of medical, veterinary, and biological applied research received the greatest amounts of funding (medical research projects have consistently received the largest allocations overall). These are followed by physics, chemistry, biology, and industrial engineering. The allocation made to this last sector was increased in 1984, and in fact accounted for 15 percent of the total budget.

During the same 4-year period, the amount of funding allocated to universities for scientific research increased constantly. However, the total budget was not distributed on a uniform basis, with individual universities receiving different amounts of funding.

The greater part has been taken up by Campania and Sicily (with progressive reductions), by Emilia Romagna (subject to erratic changes), by Lazio and Lombardy (relatively stable) and by Tuscany (with constant increases).

There are 21 universities and university-level institutions located in the South of Italy, with at least one establishment in each of the eight regions of the South (Chart M).

The trend that has emerged for the allocations made to these regions is in total contrast to the overall system adopted for the allocation of financing to universities in Italy as a whole. Although, as we have already said, the size of budget allocations made each year to research projects of major scientific interest to the nation has grown steadily and, in fact, almost doubled during this 4-year period, the portion allocated to the South of Italy has consistently declined. In 1981, the percentage allocated to the South was 30 percent; by 1984, this figure had fallen to 25.3 percent, despite the fact that in absolute terms the allocations had been increased, though only by a small amount (Table N). What this means is that, when considered in the overall context of the total budget allocations made to universities in Italy, less importance is now attributed to the allocations made to the South.

A more in-depth analysis of the situation and, specifically, of certain universities in Italy, shows that there has been a progressive reduction in the allocations made to, for example, the University of Naples. This is true both in relation to the total allocations made to the universities in the South (falling from 36 percent of the total in 1981, to 33.1 percent in 1982, 32.4 percent in 1983 and 32.7 percent in 1984) and in relation to the total allocations made to universities in Italy as a whole (falling from 10.9 percent in 1981, to 9 percent in 1982, 8.2 percent in 1983, and 8.1 percent in 1984).

The situation at the University of Bari, on the other hand, is completely different. The allocations made to this university have grown steadily over the 4-year period in question, increasing from a figure of 2.3 billion lire in 1981 to 4.411 billion lire in 1984. This increase still holds true when the figure is considered in relation to the other universities in the South, since the percentage of the total allocations for this area taken up by the University of Bari has grown steadily over the 4 years.

Human resources in R&D

For some years now the country has been focusing its attention on the "growth" of researchers, both in the numerical sense and in terms of training. In fact, this aspect is considered to be of such importance that the experts appointed to draw up the Report to the Prime Minister on the present situation and future prospects for science and technology in Italy submitted the proposal that the number of researchers should be doubled over the next 5 years by placing 50,000 "young personnel" in research activities (on an equivalent full-time basis). "Young personnel," however, is not necessarily synonymous with "researchers" and, in fact, the only way in which aspiring researchers could be assimilated into research structures would be by employing them on the basis of "trainee" contracts. Using mathematical models, a method which has been adopted by other countries, it would be possible to establish a series of parameters to be met over time and which would determine the "requirements" and the most selective method of training.

In the meantime, what could be done in Italy would be to initiate a process involving the upgrading of infrastructures and systems and of increasing the technical support provided for research.

With regard to the highly specialized personnel in whom to invest, we must point out that the first cycle of research doctorates, initiated in the academic year 1983-84, will soon be completed, providing Italy with approximately 1,600 PhDs. This initiative is one which has encountered innumerable difficulties and uncertainties, but it is the only tool we have available today capable of training young researchers. This tool now has to be made less "centralized" and more flexible.

Research personnel in Italy

Between 1967 and 1984 the number of research personnel in Italy increased from 61,000 to approximately 112,000, with an increase in cost over the same period of 250 percent. This represents an inadequate growth rate for the requirements of the seventh most highly industrialized nation in the world. Of the total figure given above (112,000 research personnel), 61,979 are researchers, 30,480 are technical personnel and 20,425 are auxiliary staff (Table P).

From the figures available for the government research organizations, ENEL, and the state participation companies--figures which are easily available and easy to compile--it can be seen that the number of research personnel employed in these sectors has basically remained unchanged, with an increase of only a few dozen personnel (spread among researchers, technical personnel and auxilliary staff) in each organization.

However, there has been a general tendency to give priority to the hiring of technical personnel and auxilliary staff, a trend which is fully justified by the anomalous ratio of researchers to technical personnel which exists in research organizations in Italy. It must be pointed out, however, that while the sharp drop in the number of people taken on by the government bodies may be justified, nonetheless, in some sectors it greatly restricts the ability of government research organizations to contribute to the economic recovery in Italy.

The trend in industry, on the other hand, has been quite the opposite (for 1984, at least), with an increase in the number of researchers employed and a decrease in the number of technical personnel.

Public Sector Scientific Organizations

The National Research Council (CNR)

Through the various organizations of which it is comprised, the CNR plays both a specific role of its own, as well as acting as a support organization for all sectors and branches of the scientific world in Italy.

The CNR organizes and manages, on an autonomous basis, long-term plans and programs for research into and promotion of industrial technology. These plans and programs are then implemented in other establishments (specific projects, strategic programs, space program).

This organization formulates agreements and contracts to create collaboration with industry. It is responsible for international relations; it makes its structures and advisory capabilities available to government bodies, as well as providing these organizations with technical standards, type approvals and product certifications and, finally, provides general advice on scientific policy.

There are a total of 59 strategic programs. These cover seven different areas and, in 1986, will account for expenditures of more than 30 billion lire (Table Q).

The estimated cost for the first year of the ten new "third-generation" finalized projects, which have been submitted to CIPE and to the government department responsible for research and which will become operational in 1987, is 104 billion lire. In addition to these ten finalized projects, another thirteen are already in progress (Table R).

The estimated government expenditure for the Italian Space Plan is 187 billion lire; this is in addition to a surplus from 1985 of approximately 87 billion lire.

The start of activity of the Italian Space Agency is also foreseen and this will involve an additional burden for the normal CNR budget.

For 1986, the CNR has a budget of more than 900 billion lire (Tables S and T). The number of people working on an equivalent full-time basis for the organization is 5,400 (between scientific and technical personnel).

The CNR also operates through a system of research centers. While these centers cannot be classified as "science parks" in the true sense of the term, they represent the foundations for the global basis for a project for creating a national network of research centers concentrated in specific areas of the country. Today, nine such centers are already in existence; these are located in Turin, Milan, Padova, Bologna, Genova, Rome (two centers) and Naples (two centers). These nine centers comprise about 40 of the 153 CNR research institutes.

Special mention should also be made of the 1987-89 3-year development plan for the South of Italy. Under the terms of this plan, and with the support of special financing laws, the allocation of financial and human resources made to this area by the CNR should increase from 18 percent to 28 percent over the 3-year period.

ENEA

In accordance with the role assigned to this organization under the provisions of the National Energy Program, ENEA is actively involved in the energy sector.

In 1986, ENEA has a total budget of approximately 1.1 trillion lire. The organization employs a total of 4,800 people, 3,400 of whom are researchers and technical personnel.

INFN

INFN is responsible for the promotion, coordination and execution of research in the areas of sub-nuclear physics, pure nuclear physics and fundamental interactions, as well as for promoting technological development in the above areas.

INFN's budget allocation for 1986 is 104.740 trillion lire. The organization employs more than 2,800 people.

The National Health Department

The National Health Department employs about 1,300 people. The work conducted by this organization is concerned strictly with specific health research projects and with implementation of the objectives of the National Health Service.

Other research organizations

There are a number of specialized organizations and institutes forming part of the overall scientific research sector in Italy. These organizations make a significant contribution to certain areas of research despite the fact that the financial resources available to them are of a low level.

Collaboration between government research organizations and other research organizations and manufacturers

The CNR has recently drawn up outline agreements and contracts with the following:

IRI (Institute for the Reconstruction of Industry):

For the creation of a network of centers of innovation and science parks in Italy, in order to promote collaboration between IRI, the CNR, and possible third parties;

ENI (National Hydrocarbon Corporation):

Providing funding of 30 billion lire a year for 90 companies operating in the sectors of pure and secondary chemistry, new materials, biotechnology, biodiagnostics and bioinstrumentation;

EFIM

For the creation of two "centers of excellence;" one of these is to be located in Florence and will operate in the sector of optoelectronics, while the other center, located in Venice, will operate in the sector of glass for special applications;

SQRIN Biomedica

For the production of cardiac valves for use in the Icaros program (artificial hearts);

The Second University of Rome

The objective of this agreement is to establish a CNR research center within the university itself; this center would then be used by the research organizations which presently report to the Frascati center.

A number of outline agreements and contracts have also been drawn up with various regional authorities (those of Calabria, Emilia Romagna, Lazio, Liguria, Piedmont, Sardinia, Sicily and Tuscany), as well as with public and private organizations and authorities and various industrial associations (such as the Confindustria, the Unioncamere, Formez and the Italian Touring Club).

The creation of data bases and the spread of information and newsletters implemented as part of the Technological Observatory (strategic program) make this Observatory an extremely valid point of reference for both the scientific community and the production sector, since it guarantees an interface between the producer of scientific knowledge and the end user of the research activity.

With regard to ENEA, the initiatives of this organization for promoting technological innovation form part of the 5-year plan. These initiatives focus on the spread and transfer of technology, with special emphasis on small and medium-size companies.

Scientific Research and Technological Innovation in Industry in Italy

(Overview of economic development)

Resources for industrial R&D

Technological change is a continuous process which is not confined solely to R&D laboratories and departments but also involves the stages of design, production, and marketing. During these stages, a company acquires experience and gains information which enable it to upgrade its products and the processes it employs on a continuing basis. It must also be remembered that there is not necessarily a direct relationship between resources allocated to R&D and innovative activity.

Over the last 5 years, R&D expenditures by Italian industry have more than doubled not only in nominal terms but also in real terms, even

when the rate of inflation in Italy is taken into account. Whereas, between 1982 and 1983, the contribution made to R&D by the public sector increased from 12 percent to 18 percent of industrial R&D, this level then decreased to today's level of 16 percent (projection for 1986). The percentage of R&D activity funded from abroad has also increased.

In 1983, R&D in industry focused mainly on certain areas of manufacturing, such as chemicals and pharmaceuticals (22 percent of total spending), the electricity industry, electronics and telecommunications (18.5) percent, automobiles (14 percent), other means of transportation (13 percent) and office equipment and computers (6 percent). R&D expenditures were lower in mechanical engineering and metal products, and still lower in traditional sectors such as foodstuffs, textiles, clothing, and timber--sectors which normally introduce innovative process technologies, often acquired from other sectors.

In 1983, the number of people employed in R&D in Italy increased by 1,604; of this figure, 1,441 were researchers. This brought the total number of people employed in R&D to 51,504, 20,976 of whom were researchers. In 1984, total R&D personnel increased by 1,367, bringing the total to 52,871, 22,926 of whom were researchers.

The text of the CNR report also deals with the following topics, which are omitted here:

- Statistics on patents;
- Patents in Italy;
- Italian patents in the United States;
- Innovation in the manufacturing sector in Italy;
- Technological Balance of Trade;
- Technological indicators and individual policy proposals.

TABLE A - Percentage Breakdown of Government Financing of R&D According to Socio-Economic Objectives for 1984

Socio-economic	West Germany	France	U.K.	Italy	U.S.A.	Japan
Environment	2.0	1.5	1.7	1.4	1.4	1.1
Infrastructures	1.1	2.2	0.5	0.9	2.5	1.4
Land-use planning	1.1	1.3	1.0	0.6	0.1	1.1
Pollution	3.0	0.4	1.2	0.8	0.5	1.4
Health	3.2	3.8	3.6	8.3	11.3	2.5
Energy	15.2	7.7	5.1	22.7	5.8	14.0
Agricultural productivity	2.1	3.7	5.0	5.0	2.1	10.9
Industrial productivity	12.0	11.1	7.1	18.2	0.2	6.1
Quality of life	2.3	1.6	0.9	1.3	1.2	0.7
Space	3.9	5.6	1.8	6.4	5.2	4.4
University research	32.6	12.1	14.7	20.2	0.0(a)	51.8
Pure research	11.4	14.3	6.8	5.7	3.9	1.7
Non-classified research	-	1.6	0.3	0.1	-	-
Defense	10.0	33.4	50.4	8.3	66.0	2.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Compiled by ISRDS from Eurostat data. Public sector financing of Research and Development 1975-1985, Luxembourg, 1986. National Science Foundation. DSTIA-DSRS. International Science and Technology update 1986. Washington, NSF.

Note: (a) The federal government of the United States makes no provision for funding of general R&D in universities.

TABLE B - Breakdown of R&D Expenditure by Companies by Industrial Sectors in Some OECD Countries in 1981

	Electrical and electronics	Chemical and pharmaceutical	Aerospace	Transportation	Metallurgy	Mechanical engineering	Other sectors of the chemical industry	Other production sectors	Services	Total
	(percentage)									
U.S.A.	46.1	40.9	75.3	47.2	35.7	62.0	37.1	49.6	38.8	50.2
Japan	16.9	16.0	-	22.7	30.3	12.3	25.9	19.8	18.5	15.1
West Germany	11.3	14.0	4.3	12.7	11.4	10.2	7.9	6.3	4.6	10.4
France	6.9	6.8	7.2	6.3	4.9	3.5	7.8	4.0	6.7	6.2
U.K.	9.7	6.5	9.2	3.0	4.0	5.0	7.7	4.5	6.1	6.9
Italy	1.7	3.4	1.5	3.1	1.5	1.5	2.3	3.3	7.7	2.5
Canada	1.8	1.8	1.4	0.4	2.5	0.8	1.6	2.8	4.0	1.7
Other OECD countries	5.6	10.6	1.1	4.6	9.7	4.7	9.7	9.7	13.6	7.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: OECD. Science and Technology Indicators. No. 2, Paris, OECD, 1986.

Tab. C - LA SPESA PER R&S IN ITALIA SECONDO IL SETTORE DI ESECUZIONE.

a) (miliardi di lire)																			
1. SETTORI	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
2. Amministrazione pubblica	169	192	227	252	275	300	373	410	517	612	782	844	953	1.187	1.769	2.125	2.586	3.195	4.222
3. - Stato	9	11	12	13	13	16	14	15	28	27	28	32	34	40	59	77	83	94	..
4. - Organismi di ricerca	50	52	80	86	90	99	117	124	165	195	282	288	372	482	727	817	963	1.253	..
5. - Università	96	112	117	134	145	154	201	220	256	307	367	393	401	468	726	913	1.161	1.848	..
6. - Altri enti	14	17	18	19	27	31	41	51	68	83	105	131	146	197	257	318	379	..	..
7. Imprese	175	207	238	302	348	384	415	507	651	740	902	1.023	1.335	1.710	2.286	2.790	3.441	4.128	5.121
8. - Pubbliche	39	43	51	68	89	98	115	149	212	217	282	278	401	569	767	1.000	1.371	1.585	..
9. - Private	136	164	187	234	259	286	300	358	439	523	640	745	934	1.141	1.519	1.790	2.135	2.543	..
10. Totale (a prezzi correnti)	344	399	465	554	623	684	788	917	1.168	1.352	1.684	1.867	2.288	2.897	4.055	4.915	6.027	7.323	9.343
11. Totale (a prezzi 1970)	389	444	497	554	581	601	620	609	660	648	677	660	697	732	866	891	952	1.042	1.222
12. Spesa per R&S in % sul PIL (a)	0,74	0,79	0,83	0,88	0,91	0,98	0,88	0,83	0,86	0,86	0,89	0,84	0,85	0,86	1,01	1,04	1,12	1,19	1,36

13. Fonte: Elaborazione dell'ISRDS su dati ISTAT.

14. Note: (a) PIL = Prodotto interno lordo.

(b) Dati di previsione.

(..) Dato non disponibile.

TABLE C - Expenditure for R&D in Italy According to Sector

a) (billions of lire)

1. Sector	8. State-owned companies
2. Government bodies	9. Private companies
3. Government	10. Total (at today's prices)
4. Research organizations	11. Total (at 1970 prices)
5. Universities	12. R&D expenditure as a percent of GNP (a)
6. Other organizations	13. Source: Compiled by ISRDS from ISTAT data.
7. Industry	14. Notes: (a) GNP = Gross National Product
	(b) Projections
	(..) Not available.

TABLE D - Estimated Allocations for Research in 1986

Sector of Research	Billions of lire at today's value	Percent
Government bodies (a)	5.473	48.9
Government	1.406	12.5
Research organizations	1.994	17.9
Universities	1.748	15.6
Other government organizations	325	2.9
Industry	5.700	51.1
ENEL	169	1.5
Parastatal companies	2.043	18.3
Private companies (b)	3.488	31.3
Total	11.173	100.0

Note: (a) Government bodies includes the organizations managed by government, the CNR, ENEA, universities and other public sector organizations which conduct research; the latter category presently includes the research organizations established under the law of March 20, 1975 and subsequent additions, as well as regional and local authorities.

(b) The global estimates for 1986 are provided by ISTAT.

Source: Compiled by ISRDS from the data supplied by the individual bodies.

Tab. E - DESTINAZIONE DEL FINANZIAMENTO PUBBLICO ALLA RES IN ITALIA.

		a) (percentuale)																		
1.	SETTORI	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985 (a)
2. -	Stato	4,8	5,2	4,5	4,4	4,1	4,6	3,3	3,2	4,9	3,7	2,9	3,2	3,1	2,8	2,7	2,8	2,3	2,4	
3. -	Organismi di ricerca	28,4	26,8	34,3	32,5	31,0	31,2	29,7	28,5	29,8	29,4	32,4	31,7	36,8	36,6	37,8	34,1	30,4	32,3	81,7
4. -	Università	58,0	57,3	50,6	51,2	50,8	48,6	51,8	51,5	46,5	46,6	42,4	43,6	39,3	35,0	36,5	37,0	36,5	46,2	
5. -	Altri enti pubblici	7,1	7,9	7,2	6,5	8,6	9,3	9,6	10,5	11,1	11,3	10,8	13,1	13,0	13,5	12,4	12,4	11,0		
6. -	Imprese pubbliche	1,2	0,4	2,0	1,9	1,8	2,0	1,9	2,0	3,3	3,0	3,9	3,2	3,8	4,4	5,0	7,6	10,9	12,2	
7. -	Imprese private	0,5	2,4	1,4	3,5	3,7	4,3	3,7	4,3	4,4	6,0	7,6	5,2	4,0	7,7	5,6	6,1	8,9	6,9	18,3
8.	Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
9.	Totale in miliardi di lire (a prezzi 1970)	188	217	246	263	267	277	305	284	311	316	348	319	306	332	409	432	498	552	660

10. Fonte: Elaborazione ISRDS su dati ISTAT.

11. Note: (a) Dati di previsione.

TABLE E - Distribution of Public Sector Financing for R&D in Italy

a) (percentage)

- | | |
|--------------------------------------|--|
| 1. Sector | 6. State-owned companies |
| 2. Government | 7. Private companies |
| 3. Research organizations | 8. Total |
| 4. Universities | 9. Total in billions of lire (at 1970 prices) |
| 5. Other public sector organizations | 10. Source: Compiled by ISRDS from ISTAT data. |
| | 11. Note: (a) Projection. |

Tab. F - RIPARTIZIONE DEGLI STANZIAMENTI PER RICERCA DEL SETTORE PUBBLICO PER SETTORI DISCIPLINARI ED ENTI NEL 1964.

a) (miliardi di lire)														
1. SETTORI DISCIPLINARI	b) Min. pubblica istruzione	c) Min. difesa	d) Min. agricoltura e foreste	e) Min. opere pubbliche	f) Casa Mezz. edilizia	g) Altri enti	h) CN R	i) BNEA	j) INPN	k) Altri enti di ricerca	l) Regioni e comuni	m) Contributi internazionali	n) Totale settore pubblico	o
2. Sc. matematiche	89.134	-	-	-	-	-	11.656	-	-	440	-	-	101.130	1,85
3. Sc. fisiche	134.575	29.014	-	2.854	15.447	1.000	65.522	94.300	222.698	8.015	10	84.560	659.395	12,06
4. Sc. chimiche	164.287	4.433	-	17.695	-	3.258	53.352	-	-	257	690	223	244.195	4,46
5. Sc. biol. e mediche	471.887	2.070	-	35.962	-	2.308	58.735	21.623	-	8.839	2.928	8.838	613.190	11,20
6. Sc. geol. e minerarie	55.927	-	-	-	-	4.538	24.341	-	-	14.022	104	65	98.997	1,81
7. Sc. agrarie	164.287	-	51.940	-	82.493	135	33.865	-	-	12.522	4.597	8.013	357.852	6,54
8. Sc. med. e farm. fisiologiche	218.466	-	-	-	-	16.391	13.724	-	-	-	40	741	249.362	4,56
9. Sc. fis. e politiche	122.341	-	-	-	-	145	9.044	-	-	125	49	200	131.904	2,41
10. Sc. econ. social. e statist.	61.171	-	-	-	-	347	6.682	-	-	13.881	2.288	1.470	118.839	2,17
11. Ricerche interdisciplinari	-	-	-	-	-	-	-	686.200	-	-	-	-	686.200	12,54
12. Ricerche speciali	-	-	-	-	-	-	187.000 (a)	-	-	275	-	215.000 (f)	402.275	7,35
13. Ricerche in fisiologia e morfologia	263.655	506.031	-	571	51.190	60.614	77.069	100.812	-	19.361	2.426	14	1.083.743	19,80
14. Ricerche in fisiologia e morfologia	-	5.706	-	-	147.079	4.475	232.000 (f)	176.777	-	6.566	4.600	7.861	585.064	10,69
15. Spese generali	-	1.133	-	-	-	-	139.031	-	-	-	-	-	140.164	2,56
16. Totale stanziamenti	1.767.730 (a)	548.387	51.940	57.062	329.209 (b)	93.211 (d)	912.021	1.001.712	222.698	64.301 (c)	17.732 (e)	326.935	5.473.008	100,00
17. Aumento % rispetto al 1964	51,7	3,9	-7,2	15,2	-6,6	6,1	10,2	0,0	3,5	16,2	-26,3	21,9	23,7	
18. Percentuale sul totale	31,93	10,02	0,95	1,04	6,02	1,70	16,66	19,76	4,07	1,54	0,32	5,97	100,00	

19. Fonte: Elaborazioni dell'ISTAT sul dati delle singole amministrazioni.

(a) I dati del "Bilancio di previsione dello Stato per l'anno finanziario 1986 e bilancio pluriennale per il triennio 1986-88", Gazzetta Ufficiale della Repubblica Italiana N.14, Roma 28-2-86.

(b) Nello stanziamento sono compresi gli interventi già approvati per un totale di Lit. 112.740 mil., interventi avviati, ad istruttoria per un totale di Lit. 183.450 mil., del Progetto Strategico 3.5. e gli investimenti per i centri aziendali di ricerca scientifica per un totale di Lit. 53.010 mil. Nel 1985 la Cassa del mezzogiorno era stata inserita nella colonna "Altri ministeri ed enti".

(c) Dati non confrontabili.

(d) Gli stanziamenti dei ministeri: marina, poste e telecomunicazioni, beni culturali, esteri, si riferiscono al 1985, mentre, i dati del Ministero dell'Interno e delle finanze sono del 1983 perché non sono pervenute le relazioni delle amministrazioni che gestiscono tali fondi.

(e) Tale stanziamento è costituito dal contributo dello Stato per le ricerche spaziali.

(f) Costituisce i fondi assegnati ai Progetti strategici e finalizzati.

(g) In tale colonna sono inseriti gli altri enti pubblici di ricerca e di sperimentazione al sensi della Legge del 20-3-1975 N. 70.

(h) Per quest'anno hanno fornito informazioni sull'attività di ricerca le regioni: Valle d'Aosta, Veneto, Liguria, Calabria e Lombardia, ed i comuni di Perugia e Torino.

(i) Tale ammontare corrisponde a quello segnalato nel capitolo 8251 del bilancio di previsione del Ministero degli affari esteri sotto la voce "Contributo all'Agenzia Spaziale Europea (ASE)".

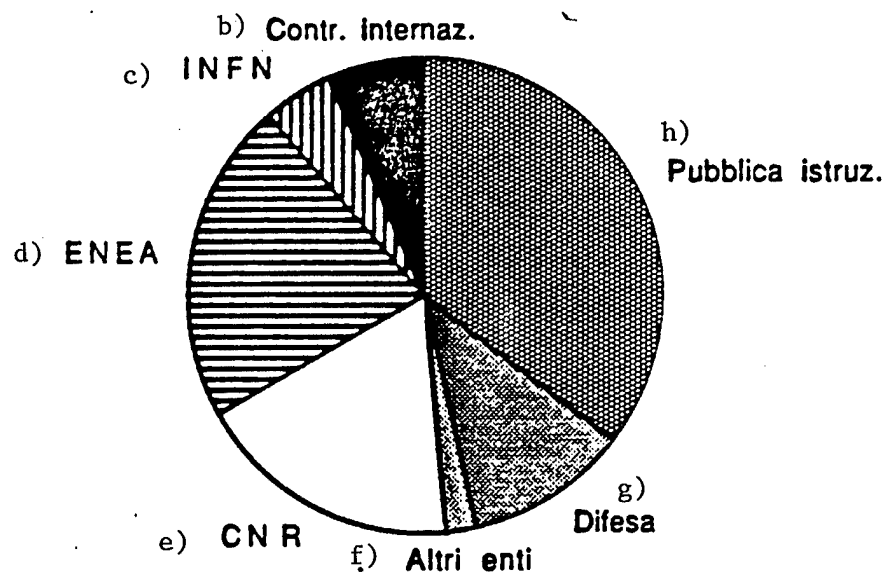
TABLE F - Breakdown of the Research Allocations in the Public Sector in 1986 by Disciplines and Organizations

a) (millions of lire)	1. Discipline
b) Ministry of Education	2. Mathematics
c) Ministry of Defense	3. Physical sciences
d) Ministry of Agriculture	4. Chemistry
e) National Health Department	5. Biological and medical research
f) Fund for the South of Italy	6. Geology and minerals
g) Other ministries and organizations	7. Agriculture
h) CNR	8. History, philosophy and philology
i) ENEA	9. Law and political sciences
j) INFN	10. Economics, sociology and statistics
k) Other research organizations	11. Nuclear research
l) Regional and borough authorities	12. Space research
m) International contributions	13. Engineering and technological research
n) Total public sector	14. Interdisciplinary research
	15. General costs
	16. Total allocations
	17. Percent increase over 1984
	18. Percent of total
	19. Source: Compiled by ISRDS from data from each organization.

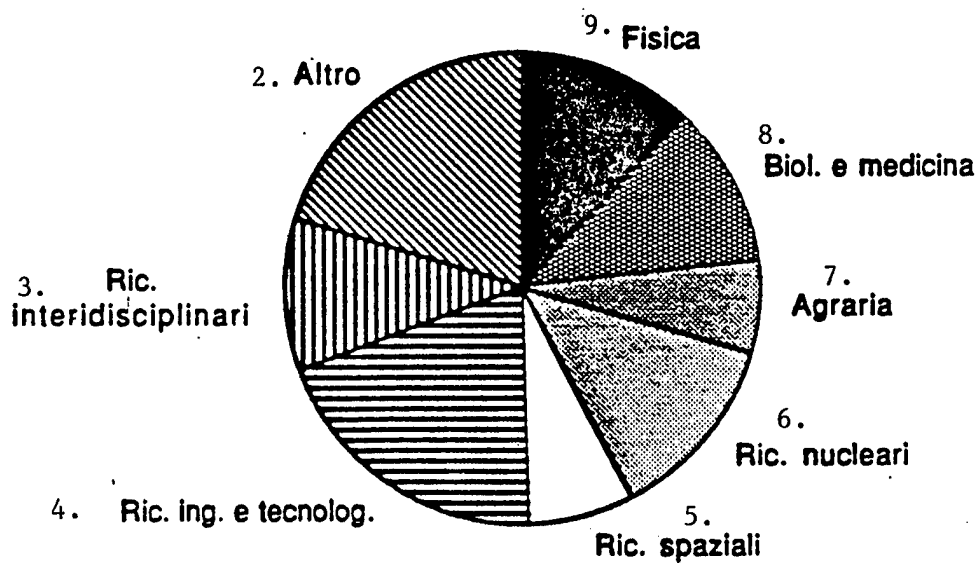
- (a) The data on the "Government Budget Projections for the financial year 1986 and the budget for the 3-year period 1986-88"---Italian Official Gazette No 14, Rome, 28-2-86.
- (b) The allocation includes work already approved for a total of 112,749 million lire, work already started, under examination for a total of 163,450 million lire of Strategic Program 3.5, and investments for company scientific research centers for a total of 53,010 million lire. In 1985 the Fund for the South of Italy came under the column entitled "Other ministries and organizations."
- (c) Non-comparable data.
- (d) The allocations for the Department of the Navy, the Post Office Department, the Department of Fine Arts and the Ministry of Foreign Affairs all refer to 1985, whereas the data for the Ministry of the Interior and the Treasury refer to 1983 because the reports of the organizations responsible for these funds were not available.
- (e) This allocation consists of the Government contribution for special research.
- (f) The funds allocated to the specific projects and strategic programs.
- (g) This column includes the other public sector research and experimental organizations required under the terms of law No 70 of 20-3-1975.
- (h) For this year the following regions have supplied information on research activity: Valle d'Aosta, Veneto, Liguria, Calabria and Lombardy, as well as the boroughs of Perugia and Turin.
- (i) This sum corresponds to the amount indicated in section 8251 of the budget projections of the Ministry of Foreign Affairs under the entry "Contribution to the European Space Agency."

Fig. G - Stanziamenti per ReS del settore pubblico nel 1986

a) ENTI



1. DISCIPLINE



10. Fonte: Tab. F

11. Per il 1986 la Cassa per il Mezzogiorno prevede uno stanziamento di 329 miliardi per attività di ReS, nell'ambito del piano di completamento delle iniziative già incluse nei

FIGURE G - Allocations for R&D in the Public Sector in 1986

- a) Organizations
 - b) International contracts
 - c) INFN
 - d) ENEA
 - e) CNR
 - f) Other organizations
 - g) Defense
 - h) Education
-
- 1. Sectors
 - 2. Other
 - 3. Interdisciplinary research
 - 4. Engineering and technological research
 - 5. Space research
 - 6. Nuclear research
 - 7. Agriculture
 - 8. Biological and medical research
 - 9. Physics
 - 10. Source: Table F
 - 11. The Fund for the South of Italy will provide estimated funding of 329 billion lire for R&D in 1986, as part of the plan for completing the initiatives included in the

Tab. H - RIPARTIZIONE PER OBIETTIVI DEGLI STANZIAMENTI DEL SETTORE PUBBLICO, DELL'ENEL E DELLE IMPRESE A PARTECIPAZIONE STATALE NEL 1984

NEL 1986.

a) (milioni di lire)

OBIETTIVI	b) Min. pubblica istruz.	c) Min. difesa	d) Min. agricolt. e foreste	e) Istituto per. agricolt. e sanit.	f) Cassa di Mezz.	g) Altit. min. ed. enti	h) CNR	i) BMB	j) INFN	k) Altri enti di ricerca	l) Regioni comunit.	m) Contributi internaz. e donazioni	n) Totale attive pubbliche	o) ENEL	p) Invest. PP. St.	q) Totale generale	%
2. Ambiente terrestre	-	-	-	-	1.122	6.780	47.325	-	-	21.078	-	333	77.138	-	40.795	117.933	1,53
3. Assetto territoriale	-	-	-	-	-	17.250	34.626	-	-	-	6.295	8	58.179	-	102.270	160.449	2,09
4. Impiantamento ambiente	-	-	-	16.554	993	3.976	28.949	13.436	-	4.995	726	197	69.826	17.500	13.433	101.159	1,32
5. Salute umana	-	-	-	37.103	-	2.298	124.845	93.964	-	6.138	2.850	3.469	270.667	-	3.900	274.567	3,57
6. Energia	-	-	-	-	15.447	2.370	73.337	869.200	-	-	200	-	960.554	151.900	138.842	1.251.296	16,28
7. Agricoltura	-	-	51.940	2.283	78.252	365	82.148	14.112	-	16.298	4.597	10.528	260.543	-	10.324	270.867	3,52
8. Industria	-	-	-	-	233.105	41.781	163.437	91.000	-	18.242	2.200	2.429	552.194	-	1.070.741	1.622.935	21,12
9. Vita sociale	-	-	-	-	-	16.883	36.716	-	-	14.847	818	2.259	65.523	-	1.572	67.095	0,87
10. Spazio	-	-	-	-	-	-	206.654	-	-	273	-	215.000	421.927	-	172.353	594.280	7,73
11. Ricerca universitaria	1.747.730	-	-	-	-	-	-	-	-	-	-	-	1.747.730	-	-	1.747.730	22,74
12. Ricerche non universitarie	-	-	-	-	-	200	114.534	-	222.698	2.430	46	92.762	432.670	-	14.587	447.257	5,82
13. Non classificato	-	-	-	1.142	290	1.248	4.950	-	-	-	-	-	7.670	-	102.450	110.120	1,43
14. Difesa	-	-	548.387	-	-	-	-	-	-	-	-	-	548.387	-	371.092	919.479	11,96
15. Totale	1.747.730	548.387	51.940	57.082	329.209	93.211	912.021	1.081.712	222.698	84.301	17.732	326.985	5.473.008	169.400	2.042.759	7.615.167	100,00

16. Fonte: Elaborazione dell'ISRS su dati del singolo ente.

TABLE H - Breakdown by Objectives of the Allocations of the Public Sector, ENEL and Parastatal Companies in 1986

a) (millions of lire)	1. Objective
b) Ministry of Education	2. Environment
c) Ministry of Defense	3. Land-use planning
d) Ministry of Agriculture	4. Environmental pollution
e) National Health Department	5. Health
f) Fund for the South of Italy	6. Energy
g) Other ministries and bodies	7. Agriculture
h) CNR	8. Industry of life
i) ENEA	9. Quality of life
j) INFN	10. Space
k) Other research organizations	11. University research
l) Regional and borough authorities	12. Pure research
m) International contributions	13. Non-classified research
n) Total public sector	14. Defense
o) ENEL	15. Total
p) Parastatal companies	16. Source: Compiled by ISRS from data from each organization.
q) Total	

Tab. L. - RISORSE FINANZIARIE IMPEGNATE DAGLI ALTRI ENTI DI RICERCA NEL 1986 PER OBIETTIVI SECONDO LA CLASSIFICAZIONE NARS DELLA COMUNITA' EUROPEA.

I. OBIETTIVI	a) ISPE	b) ISCO nazionale	c) Ist. nazionale nutriz.	d) Ist. G. Ferraris nazionale	e) Ist. nazionale geofis.	f) INBA	g) Ist. archit. navale	h) Ist. alta matem.	i) Osserv. geofis. specim.	j) Ist. naz. ottica	k) ISPOL naz. sem. elettr.	l) Fine	m) ISPESL	n) Ist. naz. selvagg.	o) Ist. medic. sociale	p) Totale	%
Ambiente terrestre 2.					7.056				14.022							21.078	25,00
Assetto territoriale 3.																	
Implementazione ambiente 4.																	
Salute umana 5.			2.990 (a)														
Energia 6.																	
Agricoltura 7.			1.520			5.554											
Industria 8.			257	7.990			4.000										
Vita sociale 9.	5.600	6.937	1.002								1.308						
Spazio 10.										273						273	0,32
Ricerche non orientate 11.			1.031					440		959						2.430	2,88
Ricerche non classificate 12.																	
Totale 13.	5.600	6.937	6.800	7.990	7.056	5.554 (b)	4.000	440	14.022	1.779	1.308	5.517 (c)	13.893	3.160	245	84.301	100,00

Fonte: ISRDs sui dati dei singoli enti. 14.

Note: (a) Totli 600 milioni del contratto del CNR.

(b) Totli 119 milioni dal CNR.

(c) La cifra si riferisce al 1985 ed è comprensiva oltre che dell'attività di ricerca anche dell'attività di controllo e certificazione delle sementi.

TABLE L - Breakdown by Objectives of the Financial Resources Used by the
Other Research Organizations in 1986, Based on the E.E.C. NABS
Classification

- a) ISPE
 - b) ISCO - National Institute for the Study of the Economic Situation
 - c) National Institute of Nutrition
 - d) G. Ferraris Institute
 - e) National Institute of Geophysics
 - f) INEA
 - g) Institute of Naval Architecture
 - h) Higher Institute of Mathematics
 - i) Experimental geophysics observatory
 - j) National Institute of Optics
 - k) ISFOL
 - l) National Organization for Electrical Semiconductors
 - m) ISPESL
 - n) National Wildlife Institute
 - o) Italian Institute for Social Medicine
 - p) Total
-
- 1. Objective
 - 2. Environment
 - 3. Land-use planning
 - 4. Environmental pollution
 - 5. Health
 - 6. Energy
 - 7. Agriculture
 - 8. Industry
 - 9. Quality of life
 - 10. Space
 - 11. Pure research
 - 12. Non-classified research
 - 13. Total
 - 14. Source: ISRDS from data from each organization
 - 15. Notes: (a) Without 600 million lire of the CNR contract
 - (b) Without 119 million lire given by the CNR
 - (c) The figure refers to 1985 and includes both research activity as well as the control and approval of the seeds.

CHART M - Universities in the South of Italy

State universities

Abruzzi	L'Aquila, Chieti
Basilicata	University of Basilicata
Calabria	University of Calabria, Reggio Calabria
Campania	Naples, Salerno
Molise	University of Molise
Puglia	Bari, Lecce
Sardinia	Cagliari, Sassari
Sicily	Catania, Messina, Palermo

Institutes with special statutes

Campania	Naval Institute of Naples Oriental Institute of Naples
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University Institutes recognized by the Ministry of Education

Campania	Naples
Sicily	Catania

ISEF - Higher Institutes of Physical Training

Campania	Naples
Sicily	Palermo

There are substantial differences from one region to another and from one establishment to another. In Sicily there are three state universities of long standing (in Catania, Messina and Palermo) offering a wide choice of faculties and degree courses, whereas in Basilicata and Molise the universities were established only recently and offer a fairly limited range of courses.

The funding provided for scientific research in the four-year period 1981-1984

Tab. N - FINANZIAMENTI PER RICERCA SCIENTIFICA (40%) ASSEGNATI ALLE UNIVERSITA' DEL MEZZOGIORNO.
SUDDIVISIONE PER REGIONE. ANNI 1981-84.

		a) (in milioni di lire)															
		b) ANNO 1981				c) ANNO 1982				d) ANNO 1983				e) ANNO 1984			
1. REGIONE	f) Importo assegnato	% sul totale Mezz.	g) % sul totale Italia	h) % sul totale Italia	i) Importo assegnato	% sul totale Mezz.	j) % sul totale Italia	k) % sul totale Italia	l) Importo assegnato	m) % sul totale Mezz.	n) % sul totale Italia	o) Importo assegnato	p) % sul totale Mezz.	q) % sul totale Italia			
2. Abruzzi	376,80	2,20	0,67	0,92	734,85	3,36	0,92	3,60	775,04	3,60	0,92	1.085,50	3,99	1,01			
3. Basilicata	..	..	..	..	..	..	..	..	..	..	..	9,00	0,03	0,01
4. Calabria	955,70	5,57	1,70	1,17	935,34	4,28	1,17	4,13	888,15	4,13	1,05	1.457,40	5,36	1,36			
5. Campania	6.652,28	38,79	11,86	9,89	7.900,68	36,17	9,89	35,78	7.695,70	35,78	9,11	9.992,30	36,74	9,32			
6. Molise	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7. Puglia	2.534,30	14,78	4,52	4,50	3.597,95	16,47	4,50	16,81	3.615,20	16,81	4,28	4.723,60	17,37	4,41			
8. Sardegna	1.587,40	9,26	2,83	2,98	2.379,58	10,89	2,98	10,23	2.200,63	10,23	2,60	2.779,20	10,22	2,59			
9. Sicilia	5.042,10	29,40	8,99	7,88	6.293,00	28,81	7,88	29,46	6.336,04	29,46	7,50	7.151,60	26,29	6,67			
10. Totale Mezzogiorno	17.148,58	100,00	30,56	27,34	21.841,40	100,00	27,34	100,00	21.510,76	100,00	25,46	27.198,60	100,00	25,38			
11. Tot. Gen. Italia	56.112,20				79.901,28				84.500,00			107.177,50					

12. Note: ... dato non disponibile

13. Fonte: elaborazione ISRDS su dati del Ministero della pubblica istruzione.

TABLE N - Funding for Scientific Research (40 percent) Allocated to the Universities in the South of Italy - Breakdown by Region for the Period 1981-84

- a) (in millions of lire)
- b) 1981
- c) 1982
- d) 1983
- e) 1984
- f) Sum allocated
- g) Percent of total allocation to the South
- h) Percent of total allocation to the whole of Italy
- i) Sum allocated
- j) Percent of total allocation to the South
- k) Percent of total allocation to the whole of Italy
- l) Sum allocated
- m) Percent of total allocation to the South
- n) Percent of total allocation to the whole of Italy
- o) Sum allocated
- p) Percent of total allocation to the South
- q) Percent of total allocation to the whole of Italy

- 1. Region
- 2. Abruzzi
- 3. Basilicata
- 4. Calabria
- 5. Campania
- 6. Molise
- 7. Puglia
- 8. Sardinia
- 9. Sicily
- 10. Total for South of Italy
- 11. Total for the whole of Italy
- 12. Note: ... not available
- 13. Source: Compiled by ISRDS from data supplied by the Ministry of Education.

TABLE P - Research Personnel in Italy

(in millions of lire)

Sector of activity (number of people employed e.f.t.)

Year	Public Sector	Industry	Total	Researchers	Technical Personnel	Ancillary staff
1967	31.466	29.725	61.191	21.826	18.047	21.318
1968	33.803	32.391	66.194	24.424	19.195	22.575
1969	35.155	34.854	70.009	25.363	22.092	22.554
1970	36.989	38.387	75.376	27.618	23.867	23.891
1971	39.473	41.388	80.861	30.885	26.501	23.475
1972	44.883	41.060	85.943	32.592	28.457	28.894
1973	46.798	39.633	86.431	33.313	27.278	25.840
1974	47.723	38.932	86.655	34.308	26.549	25.798
1975	54.315	40.371	94.686	37.925	27.494	29.267
1976	56.241	39.434	95.675	37.748	27.568	30.229
1977	57.454	39.891	97.345	39.718	28.204	29.423
1978	60.073	41.793	101.866	40.779	30.376	30.711
1979	47.988	46.655	94.643	46.442	27.528	20.673
1980	47.682	48.121	95.803	46.999	27.605	21.199
1981	52.468	50.368	102.836	52.060	29.385	21.391
1982	56.027	49.900	105.927	56.707	28.027	21.193
1983	61.239	51.504	112.743	63.021	28.694	21.028
1984	60.013	52.871	112.884	61.979	30.480	10.425

Source: Compiled by ISRDS from ISTAT data.

- Notes: - e.f.t. = equivalent full-time;
 - The public sector includes research organizations, government bodies and universities; the industrial sector includes both private companies and state-owned companies.

TABLE Q - CNR: Projected Expenditure, by Major Sectors, of the Normal Budget of the CNR. The figures in the first column refer to the 1986 CNR budget.

(millions of lire)				
Expenditure	1986	1987	1988	1989
Expenditure for personnel and general support structures for research activity ("basic" expenditure				
1. General costs, organizations and computer processing	30.370	32.300	33.900	35.500
2. Research establishments	78.753	80.000	82.500	90.000
3. Other	12.180	12.000	11.600	12.500
Sub-total	121.303	124.300	128.000	138.000
Cost of personnel				
4. Personnel	270.936	320.000	345.000	370.000
5. Other training costs	7.069	3.000	4.000	5.000
Sub-total	278.005	323.000	349.000	375.000
Cost of research activity				
6. Allocations to organizations	75.929	79.000	84.500	91.500
7. Committees	46.986	48.000	50.500	54.500
8. Strategic programs	32.000	33.000	35.000	38.000
9. International relations	6.410	8.500	11.000	12.000
10. Conventions	4.450	4.900	5.500	6.000
11. Major equipment	4.200	15.000	15.000	15.000
12. General activity	1.800	2.000	2.000	2.000
13. Reserve fund	8.772	7.000	7.000	7.000
Sub-total	180.547	197.400	210.500	226.000
Total	579.855	644.700	687.500	739.000

Source: Compiled by ISRDS from the Report on the Budget Projections for the three-year period 1987-89, Rome, May 1986.

TABLE R - CNR: Funding Required in 1987-1988-1989 for the Specific Projects in Progress

Project	CIPE decision	(millions of lire)		
		1987	1988	1989
Transportation	8.6.1983	500	-	-
Cancer research	"	24.000	24.000	-
Geodynamics (vulcanology)	"	1.000	2.000	2.000
Energy (a)	22.12.82 - 8.6.83	50.656	39.208	-
Preventive medicine	27.5.1982	6.375	500	-
Infectious illnesses	"	2.125	200	-
Genetic engineering	"	2.550	200	-
Biomedical technologies	"	1.275	100	-
IPRA	"	17.786	500	-
Mechanical engineering technologies (b)	"	4.697	500	-
Economics	"	300	500	-
Solid state electronics	6.3.1985	27.500	28.500	25.500
Government bodies	"	6.161	8.582	7.829
Totals		144.925	104.790	35.329

Source: Report on the Budget Projections for the three-year period 1987-1989, Rome, May 1986.

TABLE S - CNR: Government Contribution for the Period 1980-1986:
Breakdown by Major Budget Items

	(billions of lire)						
Item	1980	1981	1982	1983	1984	1985	1986
(Today's prices)							
Normal activity	246	310	310	369	365.5	411.6	495(a)
Specific projects	80	105	105	131	179.5	188.3	203
Total	326	415	415	500	545	600	698
Space activity	32	38	26	50	145(b)	200	187
(1980 prices)							
Normal activity	246	261	220	233	208	219	263(c)
Specific projects	80	88	75	82	102	100	99
Total	326	349	295	315	310	319	352
Space activity	32	32	18	31	82	99	85

Source: Report on the Budget Projections for the three-year period 1987-1989, Rome, May 1986.

Notes: (a) This sum does not include the contribution of 38.4 billion lire obtained from FIO in 1986;

(b) This figure includes the supplement of 95 billion lire provided under the terms of law No. 432 of 6.8.1984;

(c) If we add the sum of 26 billion lire (contribution obtained from FIO in 1986, calculated at 1980 prices) to the sum of 243 billion lire (698 billion lire at 1980 prices), the overall contribution for the normal activity of the CNR is the figure shown.

TABLE T - CNR: Funding Required by the CNR for the Three-Year Period
1987-1989, Broken Down into Expenditure for the Normal
Budget and Expenditure for Specific Projects

(millions of lire)	
Year	Amount
1987	
Normal budget (see Table Q)	644.700
Specific projects in progress (see Table R)	144.925
New specific projects authorized by the MRST (including the specific project for construction)	100.000
Total	889.625
1988	
Normal budget (see Table Q)	687.500
Specific projects in progress (see amounts in Table R), with the addition of 100 billion lire for the new projects started in 1986/87	204.790
New specific projects in the "Health" sector	50.000
New specific projects in the "Agriculture and foodstuffs" sector	60.000
New specific projects in the sector "Land-use and Environment" and in the arts	70.000
New specific projects in the "hi tech" sector	70.000
Total	1.142.290
1989	
Normal budget	739.000
Specific projects in progress (see Table R), with the addition of 250 billion lire for the new specific projects started in 1986, 1987 and 1988, plus 30 billion lire for a new project in the cancer research sector scheduled for 1989	415.329
Total	1.154.329

Source: Report on the Budget Projections for the three-year period
1987-1989, Rome, May 1986

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